Field Indicators of Hydric Soils for Land Resource Regions (LRRs) A, B, D and E (Idaho, Oregon, and Washington)

(From NRCS. 2003. Field Indicators of Hydric Soils in the United States)

All soils refers to soils with any USDA soil texture. Unless otherwise indicated, all mineral layers above any of the Indicators have dominant chroma 2 or less, or the layer(s) with dominant chroma or more than 2 is less than 15 cm (6 in.) thick. Also, unless otherwise indicated, nodules and concretions are not considered to be redox concentrations. Use the following Indicators regardless of texture.

A1. Histosol.

Classifies as a Histosol (except Folist) or as a Histel (except Folistel).

Histosol User Notes: A Histosol has 40 cm (16 in.) or more of the upper 80 cm (32 in.) as organic soil material (Figure 5). Organic soil material has an organic carbon content (by weight) of 12 to 18 percent, or more, depending on the clay content of the soil. These materials include muck (sapric soil material), mucky peat (hemic soil material), or peat (fibric soil material). See glossary for definition of muck, mucky peat, peat, and organic soil material. See Figure 37 (organic soil material) in the glossary for organic carbon requirements. Histels are similar to histosols except they are underlain by permafrost.

A2. Histic Epipedon.

A histic epipedon.

Histic Epipedon User Notes: Most histic epipedons are surface horizons 20 cm (8 in.) or more thick of organic soil material. Aquic conditions or artificial drainage are required. See Keys to oil Taxonomy, pate 22 (US Department of Agriculture, NRCS, Soil Survey Staff, 1999). Slightly lower organic carbon contents are allowed in plowed soils (ibid., page 4). See glossary for definitions. See Figure 37 (organic soil material) in the glossary for organic carbon requirements.

A3. Black Histic.

A layer of peat, mucky peat, or muck 20 cm (8 in.) or more thick starting within the upper 15 cm (6 in.) of the soil surface having hue 10YR or yellower, value 3 or less, and chroma 1 or less (Figure 6).

Black Histic User Notes: Unlike indicator A2, this indicator does not require proof of aquic conditions or artificial drainage. See glossary for definitions of peat, mucky peat, and muck. See Figure 37 (organic soil material) in the glossary for organic carbon requirements.

A4. Hydrogen Sulfide.

A hydrogen sulfide odor within 30 cm (12 in.) of the soil surface.

Hydrogen Sulfide User Notes: This “rotten egg smell” indicates that sulfate-sulfur has been reduced and therefore the soil is anaerobic. In most hydric soils, the sulfidic odor is only present when the soil is saturated and anaerobic.

A10. 2cm Muck. For testing in LRRs A, B, C, and E.

A layer of muck 2 cm (0.75 in.) or more thick with value 3 or less and chroma 1 or less starting within 15 cm (6 in.) of the soil surface.

2 cm Muck User Notes: This Indicator requires a minimum muck thickness of 2 cm. Normally this expression of anaerobiosis is at the soil surface; however, it may occur at any depth within 15 cm (6 in.). Muck is sapric soil material with at least 12 to 18 percent organic carbon. Organic soil material is called muck (sapric soil material) if virtually all of the material has undergone sufficient decomposition to limit recognition of the plant parts. Hemic (muck peat) and fibric (peat) soil materials do not qualify. To determine if muck is present, first remove loose leaves, needles, bark, and other easily identified plant remains. This is sometimes called a leaf/root mat. Then examine for decomposed organic soil material. Generally muck is black and has a “greasy” feel; sand grains should not be evident. Hydric soil indicator

determinations are made below the leaf or root mat; however, root mats that meet the definition of hemic or fibric soil material are included in the decision making process for Mucky Peat, Peat, Organic Bodies, or Histic Indicators. See the glossary for the definition of muck. See Figure 37 (organic soil material) in the glossary for organic carbon requirements.

SANDY SOILS for LRRs, A, B, D and E (Idaho, Oregon, and Washington)

"Sandy soils" refers to those soils with a USDA texture of loamy fine sand and coarser. Unless otherwise indicated, all mineral layers above any of the Indicators have dominant chroma 2 or less, or the layer(s) with dominant chroma of more than 2 is less than 15 cm (6 in.) thick. In addition, unless otherwise indicated, nodules and concretions are not considered to be redox concentrations. Use the following sandy Indicators for sandy mineral soil materials:

S1. Sandy Mucky Mineral.

A mucky modified mineral layer 5 cm (2 in.) or more thick starting within 15 cm (6 in.) of the soil surface.

Sandy Mucky Mineral User Notes: "Mucky" is a USDA texture modifier for mineral soils. The organic carbon content is at least 5 and ranges to as high as 14 percent for sandy soils. The percentage requirement is dependent upon the clay content of the soil; the higher the clay content, the higher the organic carbon requirement. An example is mucky fine sand, which

has at least 5 percent organic carbon but not more than about 12 percent organic carbon. See the glossary for the definition of mucky modified mineral texture. See Figure 37 (organic soil material) in the glossary for organic carbon requirements.

S4. Sandy Gleyed Matrix.

A gleyed matrix which occupies 60% or more of a layer starting within 15 cm (6 in.) of the soil surface (Figure 4).

Sandy Gleyed Matrix User Notes: Gley colors are not synonymous with gray colors. Gley colors are those colors that are found on the gley page (Gretag/Macbeth, 2000). They have hue N, 10Y, 5GY, 10GY, 5G, 10G, 5BG, 10BG, 5B, 10B, or 5PB with value 4 or more. The gleyed matrix only has to be present within 15 cm (6 in.) of the surface. Soils with gleyed matrices are saturated for a significant duration; this is why no thickness of the layer is required. See the glossary for the definition of gleyed matrix.

S5. Sandy Redox.

A layer starting within 15 cm (6 in.) of the soil surface that is at least 10 cm (4 in.) thick, and has a matrix with 60% or more chroma 2 or less with 2% or more distinct or prominent redox concentrations as soft masses and/or pore linings (Figure 15).

Sandy Redox User Notes: Distinct and prominent are defined in the Glossary. Redox concentrations include

iron and manganese masses (reddish mottles) and pore linings (Vepraskas, 1994). Included within this concept of redox concentrations are iron/manganese bodies as soft masses with diffuse boundaries. The iron/manganese masses are 2 to 5 mm in size and have a value 3 or less and a chroma 3 or less; most commonly they are black. Iron/manganese masses should not be confused with concretions and nodules associated with plinthitic (USDA, NRCS, Soil Survey Staff, 1999) or relict concretions. Common to many redox concentrations (USDA, NRCS, 1998a) are required.

S6. Stripped Matrix.

A layer starting within 15 cm (6 in.) of the soil surface in which iron/manganese oxides and/or organic matter have been stripped from the matrix exposing the primary base color of soil materials. The stripped areas and translocated oxides and/or organic matter form a diffuse splotchy pattern of two or more colors. The stripped zones are 10% or more of the volume; they are rounded and approximately 1 to 3 cm (0.5 to 1 in.) in diameter.

Stripped Matrix User Notes: This indicator includes the indicator previously named “polychromatic matrix” (Florida Soil Survey Staff, 1992) as well as the term “streaking” (Environmental Laboratory, 1987). Common to many (USDA, Soil Survey Division Staff, 1993) areas of stripped (uncoated) soil materials 1 to 3 cm (0.5 to 1 in.) in size is a requirement. Commonly the splotches of color have value 5 or more and chroma 1 and/or 2 (stripped) and chroma 3 and/or 4

(unstripped). The matrix may lack the 3 and/or 4 chroma material. The mobilization and translocation or the oxides and/or organic matter is the important process and should result in splotchy coated and uncoated soil areas (Figures 16, 17, and 18).

LOAMY AND CLAYEY SOILS for LRRs A,B,D and E (Idaho, Oregon and Washington).

"Loamy and clayey soils" refers to those soils with USDA textures of loamy very fine sand and finer. Unless otherwise indicated, all mineral layers above any of the Indicators have dominant chroma 2 or less, or the layer(s) with dominant chroma of more than 2 is less than 15 cm (6 in.) thick. Also, unless otherwise indicated, nodules and concretions are not considered to be redox concentrations. Use the following loamy and clayey Indictors for loamy or clayey mineral soil materials:

F1. Loamy Mucky Mineral.

A mucky modified mineral layer 10 cm (4 in.) or more thick starting within 15 cm (6 in.) of the soil surface.

Loamy Mucky Mineral User Notes: "Mucky" is a USDA texture modifier for mineral soils. The organic carbon is at least 8 percent but can range to as high as 18 percent. The percentage requirement is dependent upon the clay content of the soil; the higher the clay content, the higher the organic carbon requirement. An example is mucky sandy loam, which has at least 8 percent organic carbon but not more than about 14 percent organic carbon. See the glossary for the

definition of mucky modified mineral texture. See Figure 37 (organic soil material) in the glossary for organic carbon requirements.

F2. Loamy Gleyed Matrix.

A gleyed matrix that occupies 60% or more of a layer starting within 30 cm (12 in.) of the soil surface.

Loamy Gleyed Matrix User Notes: Gley colors are not synonymous with gray colors. Gley colors are those that are found on the gley pages (Gretag/Macbeth, 2000). They have hue N, 10Y, 5GY, 10GY, 5G, 10G, 5BG, 10BG, 5B, 10B, or 5PB, with value 4 or more. The gleyed matrix only has to be present within 30 cm (12 in.) of the surface. Soils with gleyed matrices are saturated for a significant duration, this is why no thickness of the layer is required. See glossary for the definition of gleyed matrix (Figures 21 and 22).

F3. Depleted Matrix.

A layer with a depleted matrix that has 60% or more chroma 2 or less that has a minimum thickness of either:

a. 5 cm (2 in.) if 5 cm (2 in.) is entirely within the upper 15 cm (6 in.) of the soil, or
b. 15 cm (6 in.) and starts within 25 cm (10 in.) of the soil surface.

Depleted Matrix User Notes: Redox concentrations including iron/manganese soft masses and/or pore linings are required in soils with matrix colors 4/1, 4/2, and 5/2 (Figure 23). A, E and calcic horizons may

have low chromas and high values and may therefore be mistaken for a depleted matrix; however, they are excluded from the concept of depleted matrix unless common or many, distinct or prominent redox concentrations as soft masses or pore linings are present. Redox concentrations are not required for soils with matrix values of 5 or more and chroma 1 or value 6 or more and chroma 2 or 1 (Figure 24). See glossary for the complete definition of depleted matrix. The low chroma matrix must be caused by wetness and not a relict or parent material feature.

F4. Depleted Below Dark Surface.

A layer at with a depleted matrix that has 60% or more chroma 2 or less starting within 30 cm (12 in.) of the surface that has a minimum thickness of either

a. 15 cm (6 in.), or
b. 5 cm (2 in.) if the 5 cm (2 in.) consists of fragmental soil material (see glossary).

The layer(s) above the depleted matrix have value 3 or less and chroma 2 or less.

Depleted Below Dark Surface User Notes: This indicator often occurs in Mollisols but also applies to soils with umbric epipedons and dark colored ochric epipedons. For soils with dark colored epipedons greater than 30 cm (12 in.) thick, use Indicator F5. Redox concentrations including iron/manganese soft masses and/or pore linings are required in soils with matrix colors of 4/1, 4/2, and 5/2. A, E and calcic horizons may have low chromas and high values and

may therefore be mistaken for a depleted matrix; however, they are excluded from the concept of depleted matrix unless common or many, distinct or prominent redox concentrations as soft masses or pore linings are present. See glossary for the definition of depleted matrix.

F5. Thick Dark Surface.

A layer at least 15 cm (6 in.) thick with a depleted matrix that has 60% or more chroma 2 or less (or a gleyed matrix) starting below 30 cm (12 in.) of the surface. The layer(s) above the depleted or gleyed matrix has hue N and value 3 or less to a depth of 30 cm (12 in.) and value 3 or less and chroma 1 or less in the remainder of the epipedon.

Thick Dark Surface User Notes: The soil has a black or very dark gray surface layer 30 cm (12 in.) or more thick (Figures 25 and 26). The dark colored subsoil has value 3 or less, chroma 1 or less. Below the dark colored epipedon is a depleted matrix or gleyed matrix. This indicator is most often associated with overthickened soils in concave landscape positions. Redox concentrations including iron/manganese soft masses and/or pore linings are required in soils with matrix colors of 4/1, 4/2, and 5/2. A, E and calcic horizons may have low chromas and high values and may therefore be mistaken for a depleted matrix; however, they are excluded from the concept of depleted matrix unless common or many, distinct or prominent redox concentrations as soft masses or pore linings are present. See glossary for the definition of depleted matrix.

F6. Redox Dark Surface.

A layer at least 10 cm (4 in.) thick entirely within the upper 30 cm (12 in.) of the mineral soil that has:

a. matrix value 3 or less and chroma 1 or less and 2% or more distinct or prominent redox concentrations as soft masses or pore linings, or
b. matrix value 3 or less and chroma 2 or less and 5% or more distinct or prominent redox concentrations as soft masses or pore linings.

Redox Dark Surface User Notes: Redox concentrations in high organic matter mineral soils with dark surfaces are often difficult to see (Figures 27 and 28). The organic matter “masks” some or all of the concentrations that may be present. Careful examination is required in order to see what are often brownish “mottles” in the darkened materials. In some instances, drying of the samples makes the concentrations (if present) easier to see. Dried colors, if used, need to have matrix chromas of 1 or 2 and the redox concentrations need to be distinct or prominent.

In soils that are wet due to subsurface saturation, the layer immediately below the dark epipedon should have a depleted or gleyed matrix. Soils that are wet due to ponding or shallow perched layer of saturation may not always have a depleted/gleyed matrix below the dark surface. It is recommended that delineators evaluate the hydrologic source and examine and describe the layer below the dark colored epipedon when applying this indicator. Redox concentrations

including iron/manganese soft masses and/or pore linings are required in soils with matrix colors of 4/1, 4/2, and 5/2. A, E and calcic horizons may have low chromas and high values and may therefore be mistaken for a depleted matrix; however, they are excluded from the concept of depleted matrix unless common or many, distinct or prominent redox concentrations as soft masses or pore linings are present.

F7. Depleted Dark Surface.

Redox depletions, with value 5 or more and chroma 2 or less, in a layer at least 10 cm (4 in.) thick entirely within the upper 30 cm (12 in.) of the mineral soil that has:

a. matrix value 3 or less and chroma 1 or less and 10% or more redox depletions, or
b. matrix value 3 or less and chroma 2 or less and 20% or more redox depletions.

Depleted Dark Surface User Notes: Care should be taken not to mistake mixing of an E or calcic horizon into the surface layer as depletions. The “pieces” of E and calcic horizons are not redox depletions. Knowledge of local conditions is required in areas where E and/or calcic horizons may be present. In soils which are wet due to subsurface saturation, the layer immediately below the dark surface should have a depleted or gleyed matrix. Redox depletions should have associated microsites redox concentrations that occur as Fe pore linings or masses within the depletions(s) or surrounding the depletion(s).

F8. Redox Depressions.

In closed depressions subject to ponding, 5% or more distinct or prominent redox concentrations as soft masses or pore linings in a layer 5 cm (2 in.) or more thick entirely within the upper 15 cm (6 in.) of the soil surface (Figure 29).

Redox Depressions Users Notes: This indicator occurs on landforms such as: vernal pools, playa lakes, rainwater basins, grady ponds, and potholes: not micro-depressions on convex or plane landscapes.

TEST INDICATORS OF HYDRIC SOILS

The Indicators listed above should be tested for use in LRRs other than those listed. Other Indicators for testing are listed below. This list of Test Indicators is not extensive. User of the Indicators are encouraged to submit descriptions of other soil morphologies they think indicative of hydric soils along with supporting data for inclusion in subsequent editions of Field Indicators of Hydric Soils in the United States.

LOAMY AND CLAYEY SOILS.

TF2. Red Parent Material. For testing in LRRs with red parent material.

In parent material with a hue of 7.5YR or redder, a layer at least 10 cm (4 in.) thick with a matrix value 4 or less and chroma 4 or less and 2% or more redox depletions and/or redox concentrations as soft

masses and/or pore linings. The layer is entirely within 30 cm (12 in.) of the soil surface. The minimum thickness requirement is 5 cm (2 in.) if the layer is the mineral surface layer.

Red Parent Material User Notes: This indicator was developed for use in areas of red parent material such as: Triassic/Jurassic sediments in the Connecticut River valley, Permian “red beds” in Kansas, clayey red till and associated lacustrine deposits around the Great Lakes, and Jurassic sediments associated with “hogbacks” on the eastern edge of the Rocky mountains. This indicator also occurs on “Red River” flood plains such as the Chattahoochee, Congaree, Red and Tennessee Rivers. Redox features most noticeable in red materials include redox depletions and soft manganese masses that are black or dark reddish black (Figure 33).

TF7. Thick Dark Surface 2/1.

A layer at least 15 cm (6 in.) thick with a depleted matrix that has 60% or more chroma 2 or less (or a gleyed matrix) starting below 30 cm (12 in.) of the soil surface. The layer(s) above the depleted or gleyed matrix have hue 10YR or yellower, value 2.5 or less and chroma of 1 or less to a depth of 30 cm (12 in.) and value 3 or less and chroma 1 or less in the remainder of the epipedon.

Thick Dark Surface 2/1 User Notes: The soil has a black surface layer 30 cm (12 in.) or more thick. The dark colored subsoil has value 3 or less and chroma 1. Below the mollic (umbric) epipedon is a depleted

matrix or gleyed matrix. This indicator is most often associated with overthickened soils in concave landscape positions. Further testing is needed to determine if cumulic soils with surface hues of 10YR or yellower are hydric. Testing notes need to indicate on what landscape position this indicator fails. It may be necessary to limit this indictor to concave landscapes.

TF11. Reduced Vertic. For testing in all LRRs with Vertisols and Vertic intergrades.

In Vertisols and Vertic intergrades, a positive reaction to alpha-alpha-Dipyridyl that:

a. is the dominant (60% or more) condition of a layer at least 4 inches thick within the upper 12 inches (or at least 2 inches thick within the upper 6 inches) of the mineral or muck soil surface,
b. occurs for at least 7 continuous days and 28 cumulative days, and
c. occurs during a normal (within 16-84% of probable precipitation) or drier season and month. Please follow the procedures and note the considerations in Hydric Soil Tech. Note 8 (use of alpha-alpha-Dipyridyl).

Reduced Vertic User Notes: The time requirements for this indicator were identified from research in MLRA 150A in LRR T (Gulf Coastal Prairies); these or slightly modified time requirements may be found to identify wetland Vertisols and Vertic Intergrades in other parts of the nation. These soils usually have

thick dark surface horizons but Indicators F4, F5, and F6 are often lacking; possibly due to masking of redoximorphic features by organic carbon. These soils are a special case of the Problem Soils with Thick, Dark A Horizons listed in the 1987 Corps of Engineers Wetlands Delineation Manual.

SELECTED GLOSSARY (partial list)

A Horizon – A mineral horizon that formed at the surface or below an O horizon where organic material is accumulating. See USDA, NRCS Soil Taxonomy (1999) for complete definition.

Anaerobic – A condition in which molecular oxygen is virtually absent from the soil.

Aquic Conditions – Conditions in the soil represented by: depth of saturation, occurrence of reduction, and redoximorphic features. See Soil Taxonomy (1999) for complete definition.

Artificial Drainage – The use of human efforts and devices to remove free water from the soil surface or from the soil profile. The hydrology may also be modified by the use of levees and dams to prevent water from entering a site (Figure 35).

Calcic Horizon – An illuvial horizon in which carbonates have accumulated to a significant extent. See Soil Taxonomy (1999) for complete definition.

Calcium Carbonate – Chemical formula of CaCO3. Calcium carbonate effervesces when treated with cold hydrochloric acid.

Covered, Coated, Masked – These are terms used to describe all of the redoximorphic processes by which the color of soil particles are hidden by organic material, silicate clay, iron, aluminum, or some combination of these.

Depleted Matrix – A depleted matrix refers to the volume of a soil horizon or subhorizon from which iron has been removed or transformed by processes of reduction and translocation to create colors of low chroma and high value. A, E and calcic horizons may have low chromas and high values and may therefore be mistaken for a depleted matrix; however, they are excluded from the concept of depleted matrix unless common or many, distinct or prominent redox concentrations as soft masses or pore linings are present. In some places the depleted matrix may change color upon exposure to air (reduced Matrix), this phenomena is included in the concept of depleted matrix. The following combinations of value and chroma identify a depleted matrix:

1. Matrix value 5 or more and chroma 1 or less with or without redox concentrations as soft masses and/or pore linings; or
2. Matrix value 6 or more and chroma 2 or less with or without redox concentrations as soft masses and/or pore linings; or

3. Matrix value 4 or 5 and chroma 2 and has 2 percent or more distinct or prominent redox concentrations as soft masses and/or pore linings; or
4. Matrix value 4 and chroma 1 and has 2 percent or more distinct or prominent redox concentrations as soft masses and/or pore linings.

Diffuse Boundary – Used to describe redoximorphic features that grade gradually from one color to another. The color grade is commonly more than 2 mm wide. Clear is used to describe boundary color gradations intermediate between sharp and diffuse.

Distinct – Readily seen but contrast only moderately with the color to which compared. The contrast is distinct if:

1. delta hue = 0, then a.) delta value $\leq$2 and delta chroma >1 to <4, or b.) delta value >2 to <4 and delta chroma <4.
2. Delta hue = 1, then a.) delta value $\leq$1 and delta chroma >1 to <3, or b.) delta value >1 to <3, delta chroma <3.
3. Delta hue = 2, then a.) delta value = 0 and delta chroma >0 to <2, or b.) >0 to <2 and delta chroma <2.
   If the mottle and matrix both have values $\leq$3 and chroma $\leq$2, the contrast is faint, regardless of the difference in hue.

Epipedon – A horizon that has developed at the soil surface.

Faint – Evident only on close examination. The contrast is faint if:

1. delta hue = 0, then delta value $\leq$2 and delta chroma $\leq$1, or
2. delta hue = 1, then delta value $\leq$1 and delta chroma $\leq$1, or
3. delta hue = 2, then delta value = 0 and delta chroma = 0, or
   any delta hue if both colors have value $\leq$3 and chroma $\leq$2.

Fe/Mn Concretions & Nodules – Concretions are firm to extremely firm irregularly shaped bodies with sharp to diffuse boundaries. When broken in half concretions have concentric layers. In contrast, nodules when broken in half nodules do not have visibly organized internal structure. See Vepraskas (1994) for complete definition.

***Gleyed Matrix** – Soils with a gleyed matrix have the following combinations of hue, value, and chroma and the soils are not glauconitic:

1. 10Y, 5GY, 10GY, 10G, 5BG, 10BG, 5B, 10B, or 5PB with value 4 or more and chroma is 1; or
2. 5G with value 4 or more and chroma is 1 or 2; or (continued on next page)
3. N with value 4 or more; or

4. (for testing only) 5Y, value 4, and chroma 1.

In some places the gleyed matrix may change color upon exposure to air (reduced matrix). This phenomena is included in the concept of gleyed matrix.

Matrix – The dominant soil volume which is continuous in appearance and envelops microsites. When three colors exist, such as when a matrix, depletions, and concentrations are present, the matrix may represent less than 50 percent of the total soil volume.

Mollic Epipedon – A mineral surface horizon that is relatively thick, dark colored, humus rich, and has high base saturation. See Soil Taxonomy (1999) for complete definition.

Mucky Modified Texture – A USDA soil texture modifier, e.g. mucky sand. Mucky modified mineral soil with 0 percent clay has between 5 and 12 percent organic carbon. Mucky modified mineral soil with 60 percent clay has between 12 and 18 percent organic carbon. Soils with an intermediate amount of clay have intermediate amounts of organic carbon.

Pore Linings – Zones of accumulation that my be either coatings of a pore surface or impregnations of the matrix adjacent to the pore. See Vepraskas (1994) for complete definition.

Prominent – Contrasts strongly with the color to which they are compared. Color contrasts that are not faint or distinct are prominent.

Redox Concentration – Bodies of apparent accumulation of Fe/Mn oxides. Redox concentrations include soft masses, pore linings, nodules, and concretions. For the purposes of the Indicators nodules and concretions are excluded from the concept of redox concentrations unless otherwise specified by specific Indicators. See Vepraskas (1994) for complete definition.

Redox Depletions – Bodies of low chroma (2 or less) having value 4 or more where Fe-Mn oxides have been stripped or where both Fe-Mn oxides and clay have been stripped. Redox deletions contrast distinctly or prominently with the matrix. See Vepraskas (1994) for complete definition.

Redoximorphic Features – Features formed by the processes of reduction, translocation, and/or oxidation of Fe and Mn oxides. Formerly called mottles and low chroma colors. See Vepraskas (1994) for complete definition (Figure 38).

Redoximorphic Features are required in many of the Indicators. These redox concentrations (Figure 33) occur on pore linings and the pore linings occur along root channels and ped faces.

Reduced Matrix – Soil matrices that have low chroma and high value, but whose color changes in hue or chroma when exposed to air. See Vepraskas (1994) for complete definition.

Reduction – For the purpose of the Indicators, when the redox potential (Eh) is below the ferric/ferrous iron threshold as adjusted for pH. In hydric soils, this is the point when the transformation of ferric iron (Fe+++) to ferrous iron (Fe++) occurs (Figure 39).

Relict Features – Soil morphological features that do not reflect recent hydrologic conditions of saturation and anaerobiosis (Figure 40). See Vepraskas (1994) for complete definition.

Sharp Boundary – Used to describe redoximorphic features that grade sharply form one color to another. The color grade is commonly less than 0.1 mm wide (Figure 40).

Soft Masses – Redox concentrations, that are not hard, frequently within the matrix, whose shape is variable.

INDICATOR CORRELATION

1987 Manual		Regional Indicators
NON-SANDY SOILS:		
a.	Organic soils (Histosols)	A1 (Histosols)
b.	Histic Epipedon	A2 (Histic Epipedon) A3 (Black Histic)
c.	Sulfidic material	A4 (Hydrogen sulfide)
d.	Aquic or peraquic moisture regime	(none)
e.	Reducing soil conditions	TF11 (Reduced Vertic)
f(1).	Gleyed soils (gray)	F2 (Loamy Gleyed Matrix) F14 (Alaska Redox Gleyed) F15 (Alaska Gleyed Pores)
f(2).	Soils w/ bright mottles and/or low matrix chroma	F3 (Depleted Matrix) F8 (Redox Depressions) F9 (Vernal Pools) F11 (Depleted Ochric) F16 (High Plains Depressions) TF8 (Redox Spring Seeps) TF9 (Delta Ochric) TF10 (Alluvial Depleted Matrix)
g.	Soil appearing on the hydric soils list	(none)
h.	Iron & Manganese concretions	F12 (Iron/Manganese Masses) TF3 (Alaska Concretions)

Not listed in the 1987 Manual

A5 (Stratified Layers)
A6 (Organic Bodies)
A7 (5 cm Mucky Mineral)
A8 (Muck Presence)
A9 (1 cm Muck)
A10 (2 cm Muck)

F1 (Loamy Mucky Mineral)
F4 (Dep. Below Dark Surface)
F5 (Thick Dark Surface)
F6 (Redox Dark Surface)
F7 (Depleted Dark Surface)
F10 (Marl)
F13 (Umbric Surface)

TA1 (Playa Rim Strat. Layers)
TA2 (Structureless Muck)
TA3 (Coast Prairie Redox)

TF1 (? Cm Mucky Peat or Peat)
TF2 (Red Parent Material)
TF4 (Y Below Dark Surface)
TF5 (Y Below Thick Dark Surface)

SANDY SOILS

a.	Organic Soils (Histosols)	A1 (Histosols)
b.	Histic Epipedon	A2 (Histic Epipedon) A3 (Black Histic)
c.	Sulfidic material	A4 (Hydrogen sulfide)
d.	Aquic or peraquic moisture regime	(none)
e.	Reducing soil conditions	(none)
f.	Iron & Manganese concretions	(none)
g.	High organic matter content in the surface horizon	A6 (Organic Bodies) A7 (5 cm Mucky Mineral) A8 (Muck Presence) A9 (1 cm Muck) & A10 (2 cm Muck) S1 (Sandy Mucky Mineral) S2 (3 cm Mucky Peat or Peat) S3 (5 cm Mucky Peat or Peat) S7 (Dark Surface) & TA2 (Structureless Muck) TS2 (Thick Sandy Dark Surface)
h.	Streaking of subsurface horizons by organic matter	S6 (Stripped Matrix) S8 (Polyvalue Below Surface)
i.	Organic pan	S9 (Thin Dark Surface)
j.	Soils appearing on the hydric soils list	(none)
Not listed in the 1987 Manual		A5 (Stratified Layers) S4 (Sandy Gleyed Matrix) & S10 (Alaska Gleyed) TA1 (Playa Rim Strat. Layers) TS1 (Iron Staining) TS4 (Sandy Neutral Surface)

PROBLEM SOILS

Sandy soils	A5 (Stratified Layers) S6 (Stripped Matrix), S8 (Polyvalue Below Surface), S9 (Thin Dark Surface), TA1 (Playa Rim Strat. Layers), TS5 (Chroma 3 Sandy Redox)
Soils with thick dark A horizons	F4 (Dep. Below Dark Surface), F5 (Thick Dark Surface), F6 (Redox Dark Surface), F7 (Depleted Dark Surface) F13 (Umbric Surf.) F16 (High Plains Depressions) TF4 (2.5Y/5Y Below Dark Surface) TF5 (2.5Y/5Y Below Thick Dark Surface) TF6 (Calic Dark Surface) TS2 (Thick Sandy Dark Surface) TF7 (Thick Dark Surface 2/1) TF11 (Reduced Vertic)
Soils w/ red parent material	F8 (Redox Depressions), F9 (Vernal Pools), F12 Iron/Maganese Masses), TA3 (Coast Prairie Redox), TS1 (Iron Staining), TF2 (Red Parent Mtrl.), TF8 (Redox Spring Seeps)
Soils w/ low chroma parent material	S4 (Sandy Gleyed Matrix), S10 (Alaska Gleyed), F10 (Marl), TS4 (Sandy Neutral Surface)

Quick Guide to Field Indicators for LRRs A, B, D and E (Oregon, Washington and Idaho)

Soils of any texture w/ organic surface layers:	Histosols	A1
	Histic epipedon	A2
	Black histic epipedon	A3
	1 cm muck within 6 in.	A9
	2 cm muck within 6 in.	A10
Soils that smell like rotten eggs:	Hydrogen sulfide	A4
Sandy soils with high organic content surface layers:	Sandy mucky mineral	S1
Sandy soils with color (redox.) features	Sandy gleyed matrix	S4
	Sandy redox matrix	S5
	Stripped matrix	S6
Loamy soils with high organic content surface layers:	Loamy mucky mineral	F1
Loamy soils with “gray” colors within 12 inches:	Loamy gleyed matrix	F2
	Depleted matrix	F3
	Depleted below dark surface	F4

Loamy soils with thick (>12 in.) dark colored surfaces:	Thick dark surface	F5
	(2.5Y/5Y Below thick dark surface)	(TF5)
	(Thick dark surface 2/1)	(TF7)
Loamy soils w/ dark surfaces & redox features w/ in 12 in.:	Redox dark surface	F6
	Depleted dark surface	F7
	(2.5Y/5Y below dark surface)	(TF4)
Loamy soils w/ redox features in upper 6 in. (in depressions):	Redox depres.	F8
Loamy soils with redox features in vernal pools:	Vernal pools	F9
Stratified layers in upper 6 in. playas:	(Playa rim stratified layers)	(TA1)
Loamy soils in red parent materials:	(Red parent material)	(TF2)
Springs seepages w/ redox features in upper 6 in.:	(Redox spring seeps)	(TF8)
Vertic soils that test positive w/ $\alpha - \alpha$ dipyridyl in upper 12 in.	(Reduced vertic)	(TF11)

( ) indicates Test Indicator status – use with caution and documentation.

1. Soils w/ any texture with organic surface layers; otherwise skip to 2.

Histosols or Histels	A1
Histic epipedon/Black histic	A2, A3

2. Soils that smell like rotten eggs; otherwise skip to 3.

Hydrogen sulfide	A4

3. Soils that have thin layers of muck w/ in the upper 6 inches; otherwise skip to 4.

1 cm muck within 6 in.	A9
2 cm muck within 6 in.	A10

4. Soils w/ sand, very fine sand, loamy sand and loamy fine sand textures; otherwise skip to 5.

   4a. Sandy soils w/ high organic content surface layers; otherwise skip to 4b.

Sandy mucky mineral	S1

   4b. Sandy soils w/ redox. features in the upper 6 inches; otherwise skip to 5.

Sandy gleyed matrix	S4
Sandy redox matrix	S5
Stripped matrix	S6

5. Soils w/ textures from very fine loamy sand to clay; otherwise skip to 6.

   5a. Loamy soils w/ high organic content surface layers; otherwise skip to 5b.

Loamy mucky mineral	F1

   5b. Loamy soils w/ gley or redox. matrix colors in 10 to 12 inches; otherwise skip to 5c.

Loamy gleyed matrix	F2
Depleted matrix	F3
Depleted below dark surface	F4

   5c. Loamy soils w/ low chroma matrix below 12+ inches thick dark colored surfaces; otherwise skip to 5d.

Thick dark surface	F5
(2.5Y/5Y below dk. surf.)	(TF5)
(Thick dark surface 2/1)	(TF7)

   5d. Loamy soils w/ dark surfaces & redox features w/ in 12 inches; otherwise skip to 5e.

Redox dark surface	F6
Depleted dark surface	F7
(2.5Y/5Y below dark surface)	(TF4)

5e. Loamy soils w/ 5% redox features in upper 6 inches (depressions); otherwise skip to 5f.

Redox depressions F8

5f. Loamy soils w/ <5% redox features in upper 6 inches (vrnl. pools); otherwise skip to 5g.

Vernal pools F9

5g. Loamy soils w/ stratified layers in upper 6 inches in playas; otherwise skip to 5h.

(Playa rim stratified layers) (TF1)

5h. Loamy soils in red parent materials w/ redox. in upper 12 inches; otherwise skip to 5i.

(Red parent material) (TF2)

5i. Loamy soils in spring seeps w/ redox features in upper 6 inches; otherwise skip to 5j.

(Redox spring seeps) (TF8)

5j. Vertic soils w/ positive $\alpha - \alpha$ -dipyridyl reaction in upper 12 inches; otherwise skip to 6.

(Reduced Vertic) (TF11)

6. Soils meeting the hydric soil criteria (ponding or flooding); otherwise skip to 7.
7. Soils that do not match NTCHS field indicators or criteria are not likely considered hydric; however, the lack of any indicator does not exclude the soil from being classed as hydric. Such soils should be studied and their morphologies identified for further consideration.

( ) indicates Test Indicator status – use with caution and documentation.

Mottle contrast, abundance, and size

CONTRAST OF MOTTLES

Contrast refers to the degree of visual distinction between associated colors

Faint – Evident only on close examination

Distinct – Readily seen

Prominent – Contrast strongly

DISTINCT

Same Hue

2-4 units of chroma, or

3-4 units of value

2.5 Units of Hue (One page)

1 unit of chroma, or

1-2 units of value

ABUNDANCE OF MOTTLES

Few – Less than 2%

Common – 2-20%

Many – More than 20%

SIZE OF MOTTLES

Fine – Smaller than 5 mm

Medium – 5 to 15 mm

Coarse – larger than 15 mm

COLOR CRITERIA FOR MINERAL HYDRIC SOILS

Matrix chroma of 2 or less in mottled soils

Matrix chroma of 1 or less in unmottled soils

Measured immediately below the A horizon or at 10 inches, whichever is shallower